Application of Space Technology for Disaster Risk Management

Geo Smart Asia 2015

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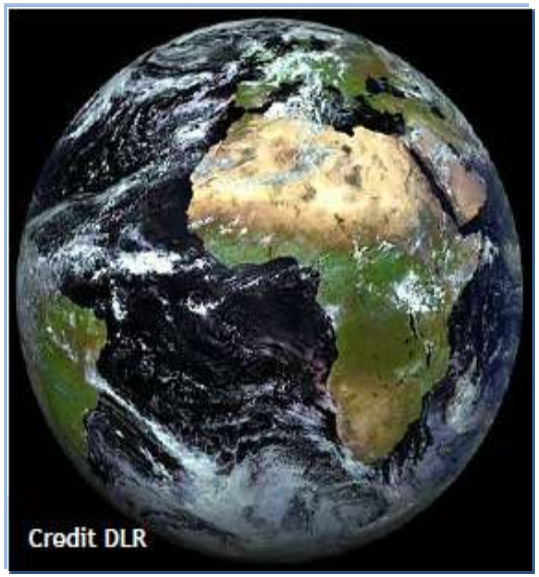
Space Technology for DRM

Space Technology is powerful tool for Disaster Risk Management (DRM)

- Wide coverage
  - ✓ Like a bird view from higher position.
- Simultaneously
  - ✓ Like a higher broadcasting tower to share information in wide area
- Robustness over a disaster
  - ✓ Not on the ground
  - ✓ Maintenance free for several years

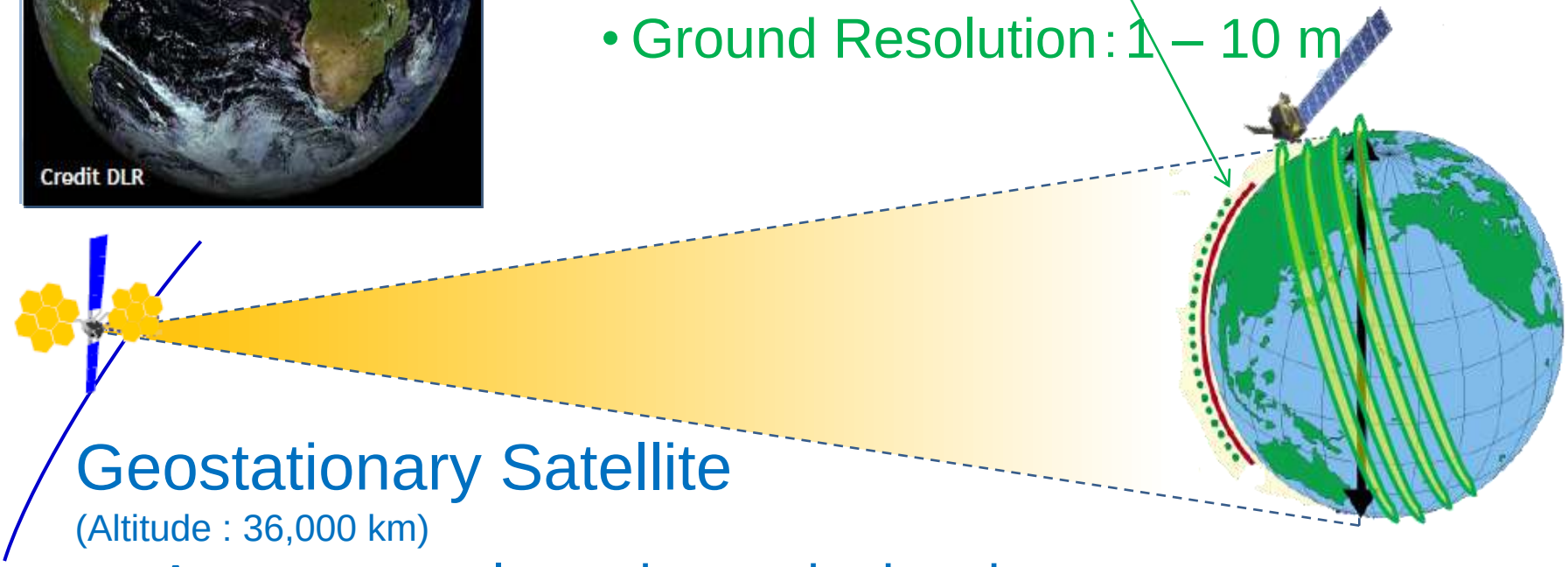
Features of Earth Observation Satellite



Earth Observation Satellite

(Altitude: 200 km – 1,000 km)

- Long revisit interval : 14 – 60 days
- Swath : 10 – 100 km
- Ground Resolution : 1 – 10 m

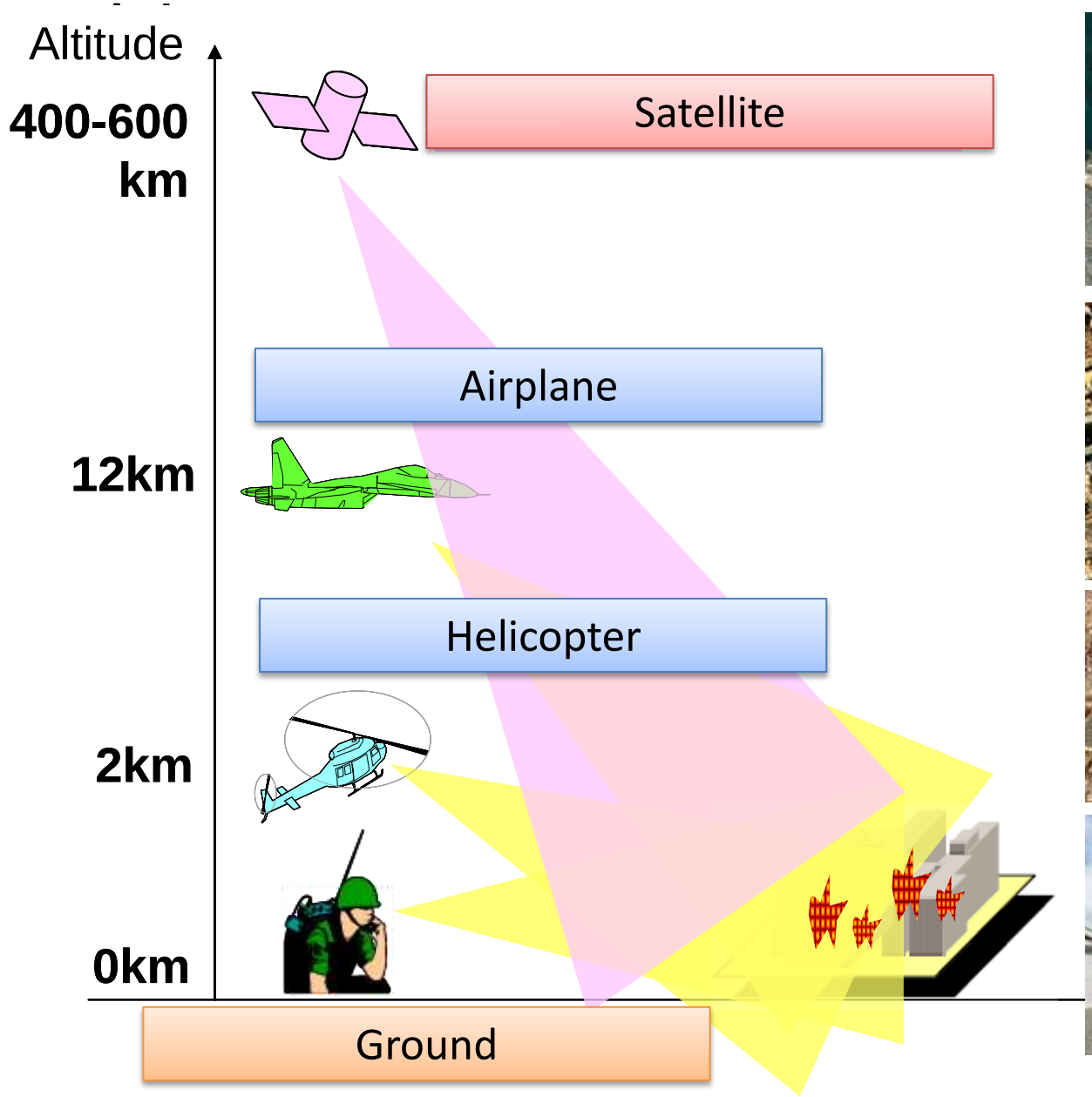


Geostationary Satellite

(Altitude : 36,000 km)

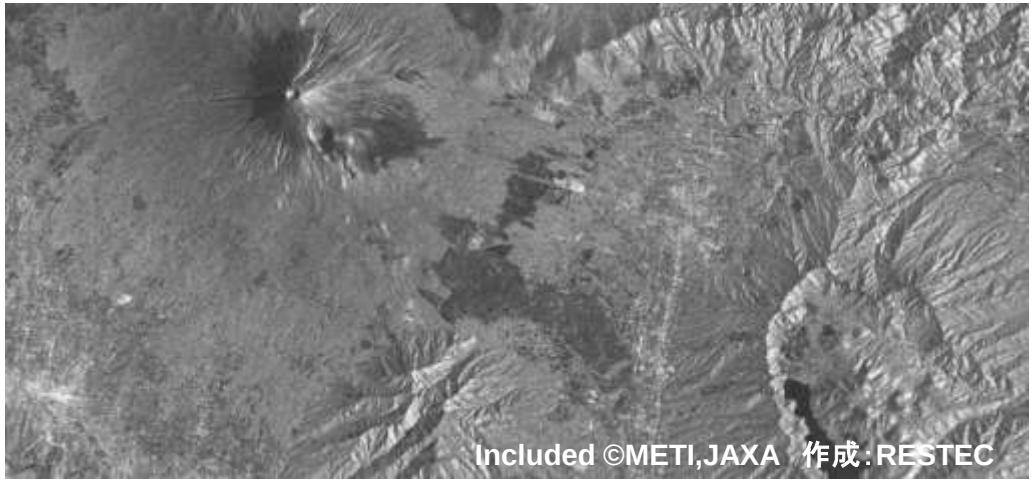
- Appears nearly stationary in the sky
- 40 percent of the earth's surface continuously
- Ground Resolution : 1 – 10 km

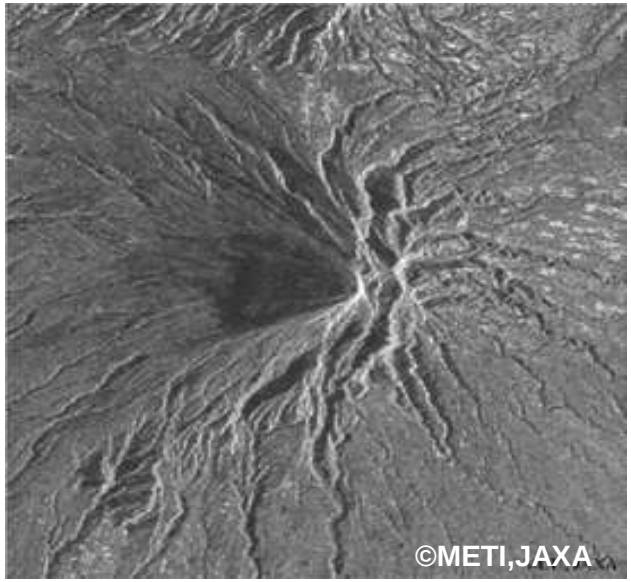
Features of Earth Observation Satellite (cont'd)



Optical Image vs. Radar Image

Optical Image





Radar Image

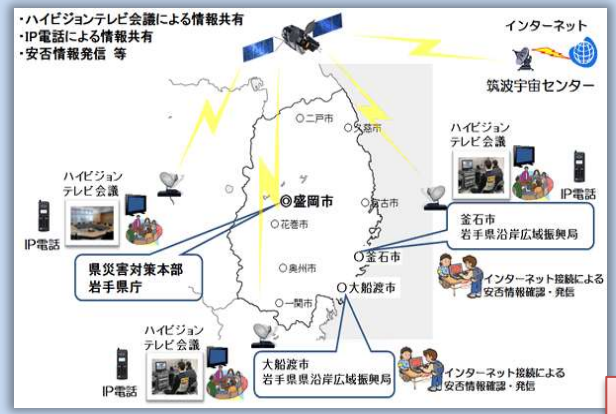

JAXA's Activities
for Disaster Risk Management

Overview of JAXA's Activities for DRM

Communications Satellites
<Backup of Ground Network>

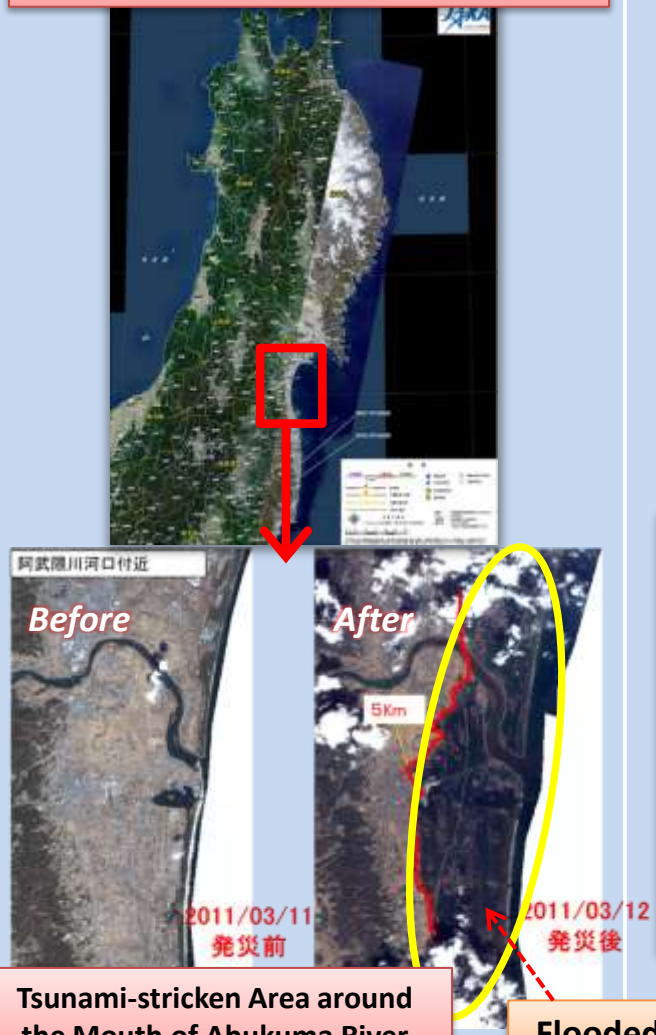
Provision of Communication Lines using CS in Iwate Pref. at the Great East Japan Earthquake

Support Disaster Countermeasures Office & Residents at Disaster Area



Earth Observation Satellites
<Emergency Observation>

Wide Area Disaster Monitoring at the Great East Japan Earthquake

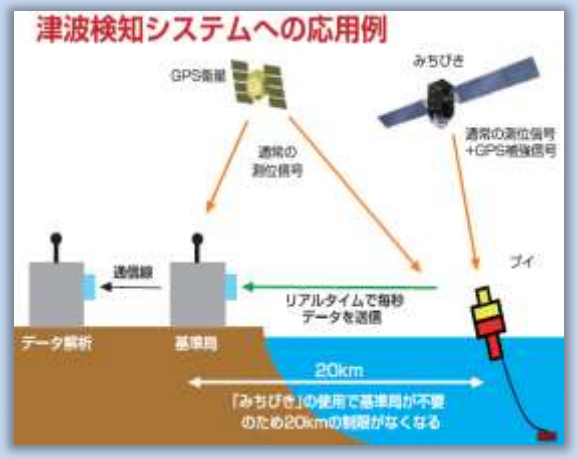


Tsunami-stricken Area around the Mouth of Abukuma River

Flooded Area

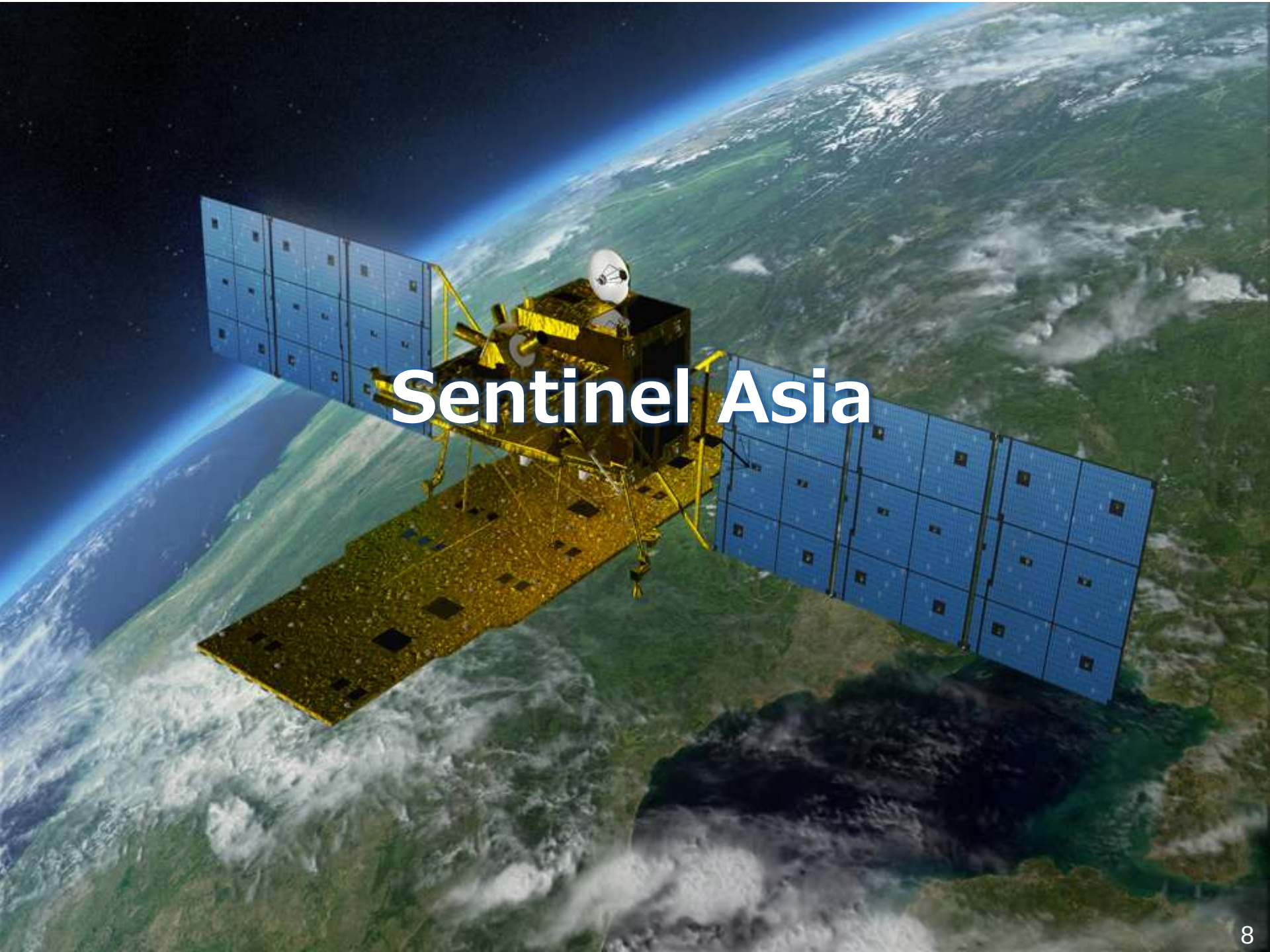
GNSS
<Tsunami Early Warning>

Tsunami Detection by GNSS buoys



Joint Exercises for Disaster Prevention/Civil Protection Implemented by the National and Local Governments

JAXA provide Satellite Image Map for Joint Exercises for Disaster Prevention/Civil Protection Implemented by the National and Local Governments


Sentinel Asia

What is Sentinel Asia

Sentinel Asia is a voluntary initiative by a collaboration between **space agencies** and **disaster management agencies**, applying **Remote Sensing** and **Web-GIS** technologies to assist disaster management in the Asia-Pacific region.

Sentinel Asia aims to:

- ✓ Improve safety in society by ICT and space technology
- ✓ Improve speed and accuracy of disaster preparedness and early warning
- ✓ Minimize the number of victims and social/economic losses.

https://sentinel.tksc.jaxa.jp/

Framework of Sentinel Asia

Space Community

APRSAF*

- Data Provision
- Promotion of Utilization
- Capacity Building

Sentinel Asia

Joint Project Team (JPT)

Join Project Team consists of total 98 organizations including 83 organizations of 25 countries/region and 15 international organizations as of September 2015

JAXA is the secretariat of JPT.

Disaster Management Community

ADRC**
Member Countries

- Utilization (User)

International Community

UN / ESCAP UN / OOSA
ASEAN AIT etc.

- International Cooperation

* Asian-Pacific Regional Space Agency Forum

** Asian Disaster Reduction Center

JPT meeting in Yangon, Myanmar in November 2014

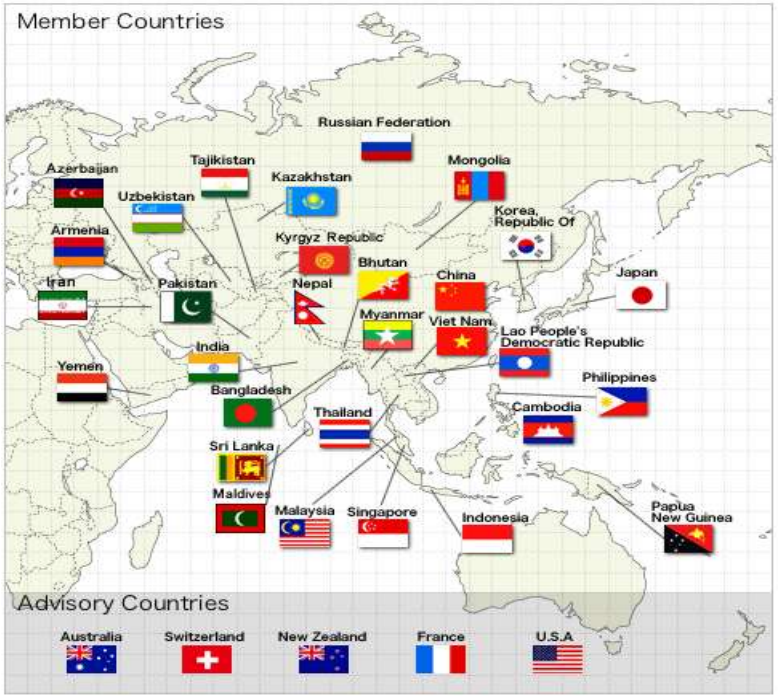
Members of Sentinel Asia

Sentinel Asia organizes Joint Project Team (JPT), and JPT consists of **98 organizations** including **83 agencies from 25 countries/region** and **15 international organizations** as of September 2015.

JAXA is the secretariat of JPT.

Also, Sentinel Asia cooperates with **ADRC** and **their members** closely, and they are also member of Sentinel Asia as well.

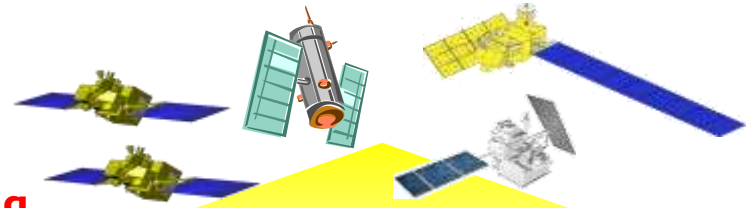
JPT + members



Concept of Sentinel Asia Step3 (2013 onwards)

Positioning satellites

Earth observation satellites



Communication satellites

Information delivering to personal terminals

Monitoring

Information/data transmission

Pre-disaster

Mitigation:

Community education

Preparedness:

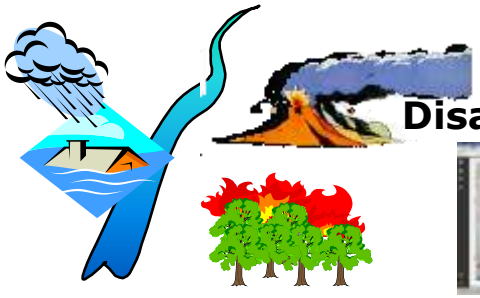
Hazard map

Early warning system

Just after disaster

Response:

Emergency observation



Disaster information

Post-disaster

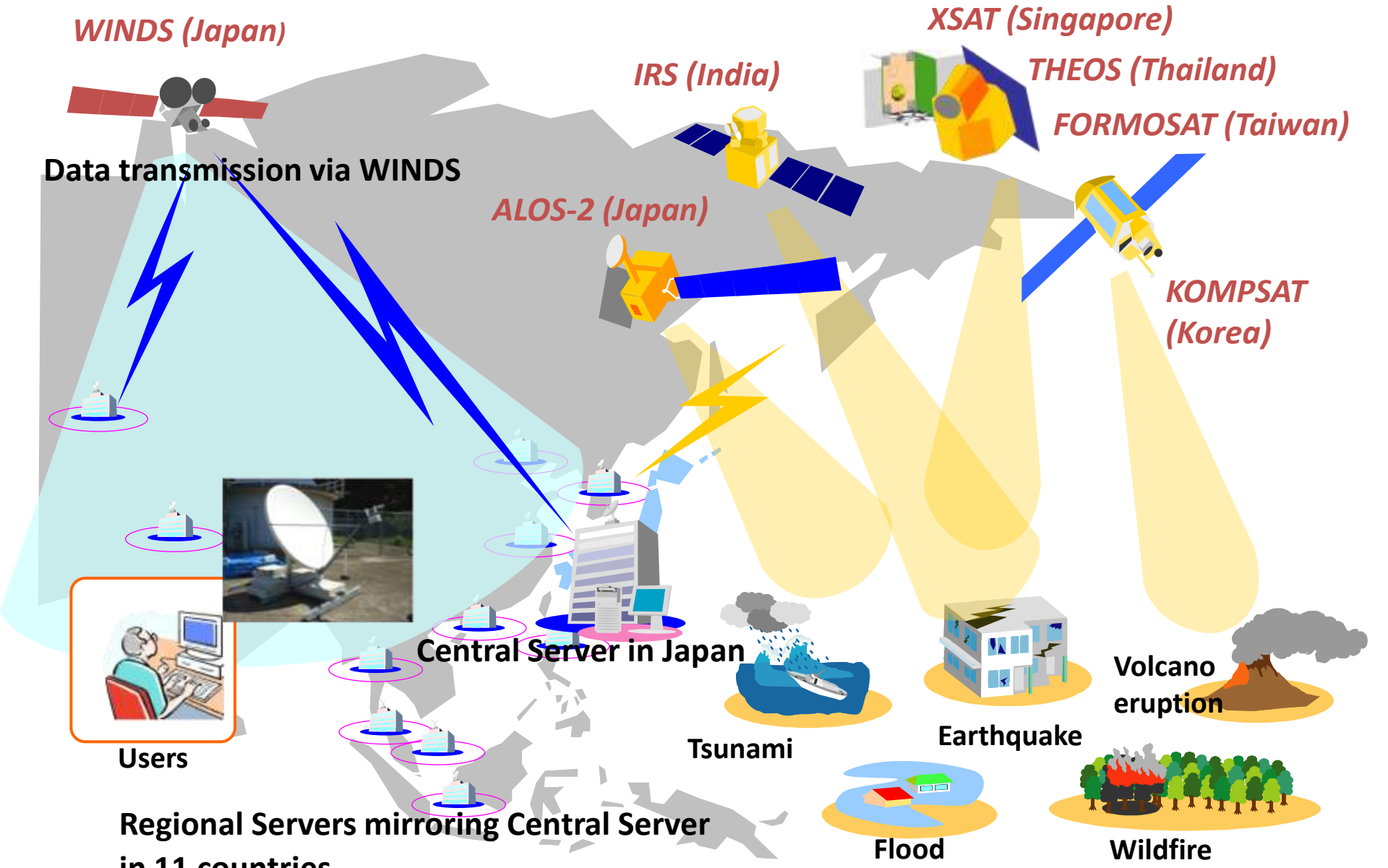
Recovery:

Monitoring

Information sharing
(Web-GIS)

Human network
Capacity Building, Outreach

Emergency Observation and Data Transmission via WINDS

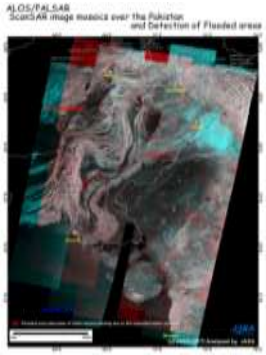


Data/Information Flow in Sentinel Asia

Users

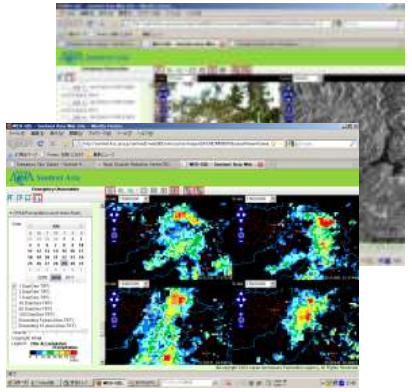
JPT Member
ADRC Member
Public

Other Information Besides Sentinel Asia



Analyzed Products

Information using Web-GIS



Sentinel Asia Step2 System

http://sentinel.tksc.jaxa.jp/

Own Data such as Map, Satellite Data

Satellite Data

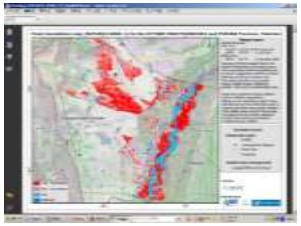
Satellite Data

Data Provider Node (DPN)

JAXA, ISRO, GISTDA
KARI, NARL

Analyzed Products

Analyzed Products



Data Analysis Node (DAN)

AIT, ADRC, ICIMOD
LAPAN, MONRE, CRISP
CEA, CAIAG, NCSRT
Sri Lanka MoDM, SD
BPPT, MO, etc.

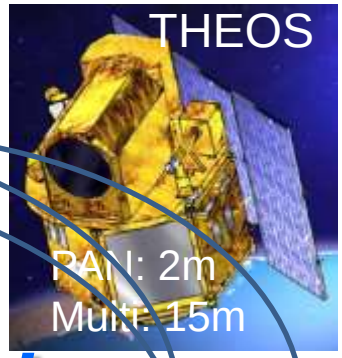
Data Provider Node (DPN)

Sentinel Asia Constellation contributing to Emergency Observations

ISRO

RESOURCESAT, OCEANSAT-2 OCM, IMS-1, CARTOSAT-1&2, RISAT-1

GISTDA



JAXA **ALOS-2**

PALSAR-2: 3-10m L-Band

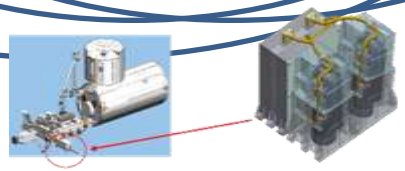
Sentinel Asia Constellation

NARL

PAN: 2m
MS: 8m

FORMOSAT-2

JAXA



KIBO HDTV-EF

CRISP

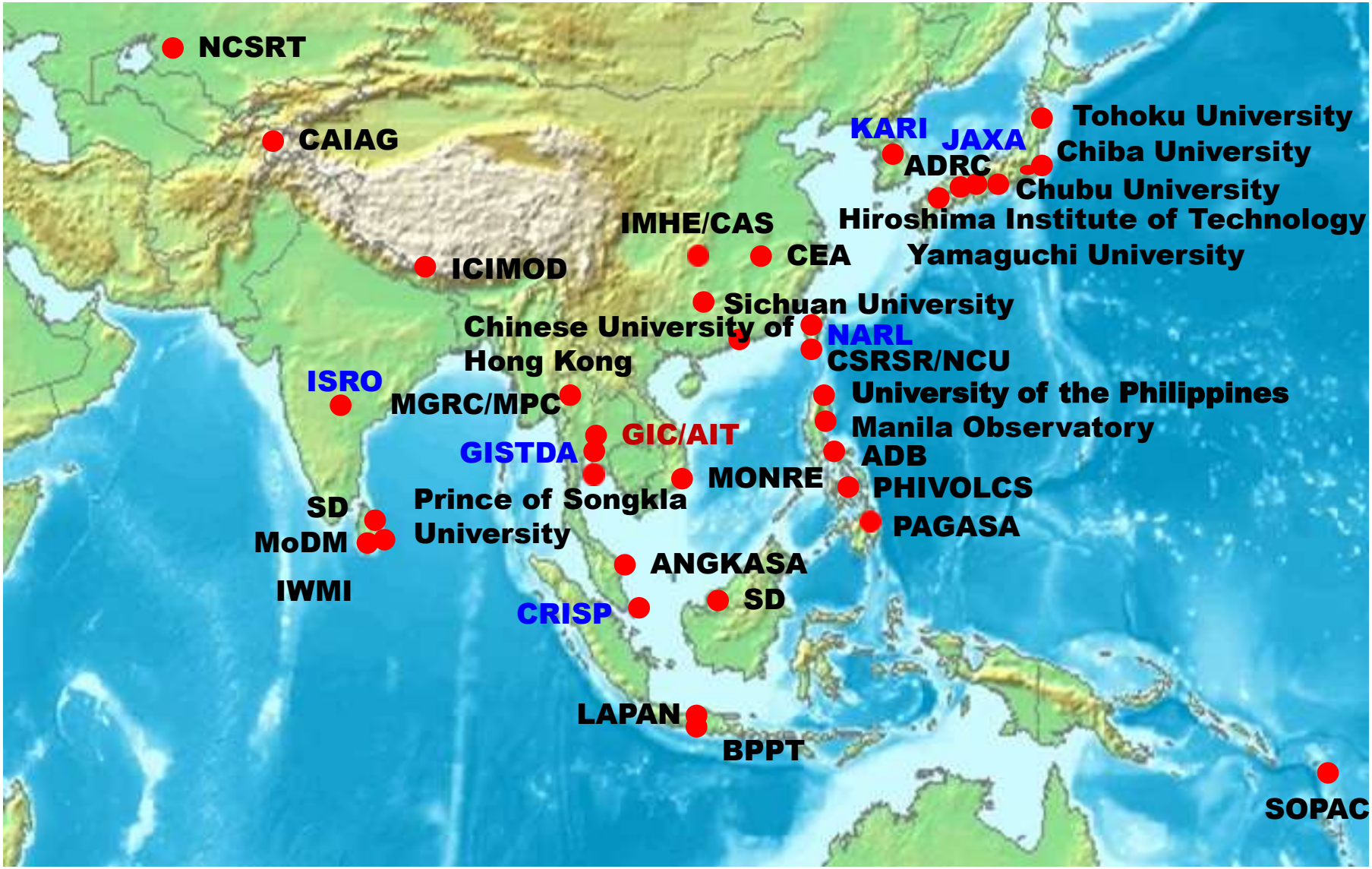
MS: 10m

XSAT

KARI

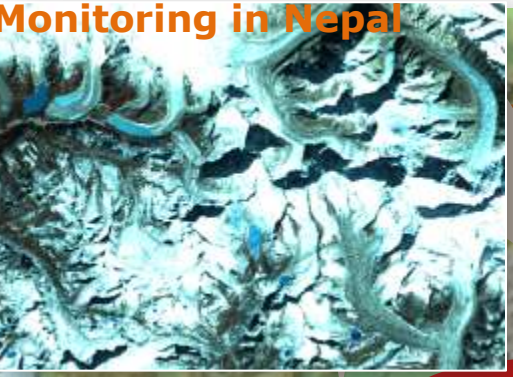
Data Analysis Node (DAN)

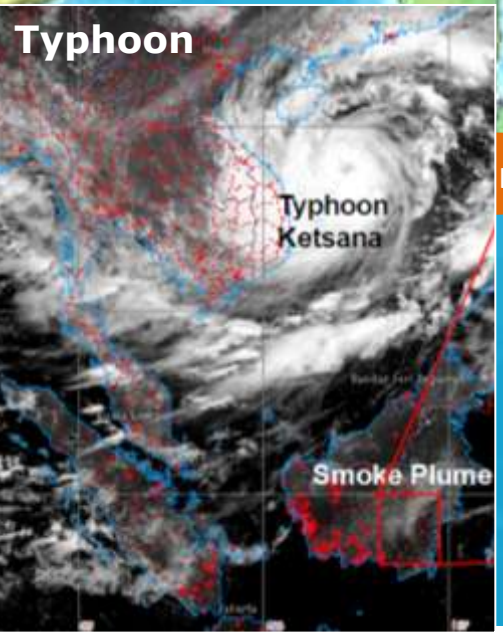
Framework of satellite data analysis to provide analyzed products

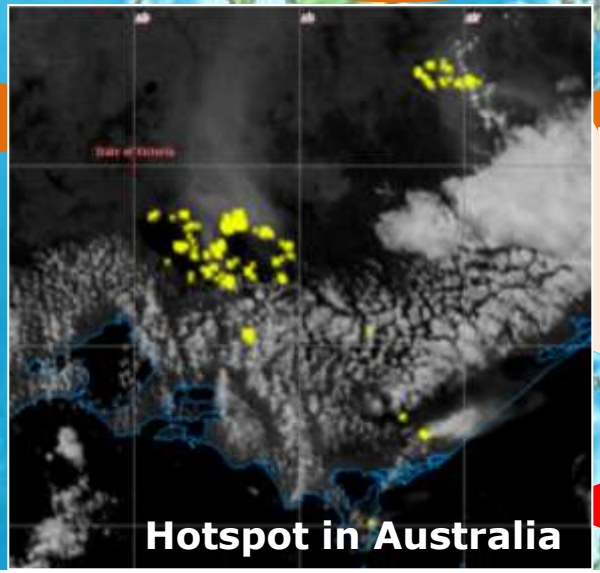


Asian Disasters Observed by Sentinel Asia

observed about 200 disasters for last 8 years



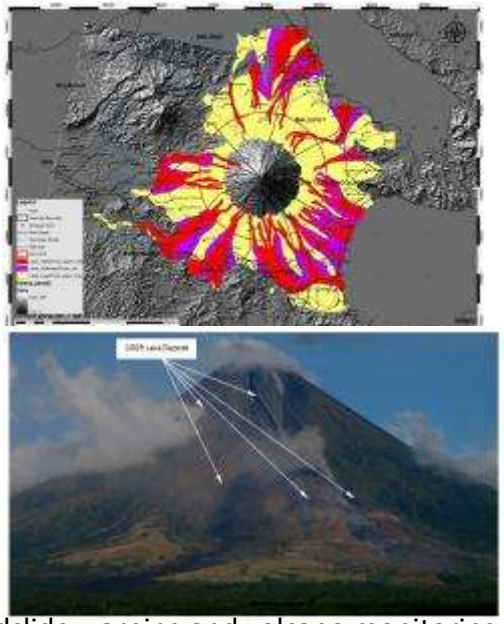




gyzstan
Japan
Nepal
Myanmar
India
Thailand
Cambodia
Philippines
Guinea
Fiji
Solomon Island
Australia
New Zealand

Success Story & Capacity Building

- **Project-based activity toward the practical use of space technology called as "Success Story"**



Study of landslide warning and volcano monitoring for Mt. Mayon

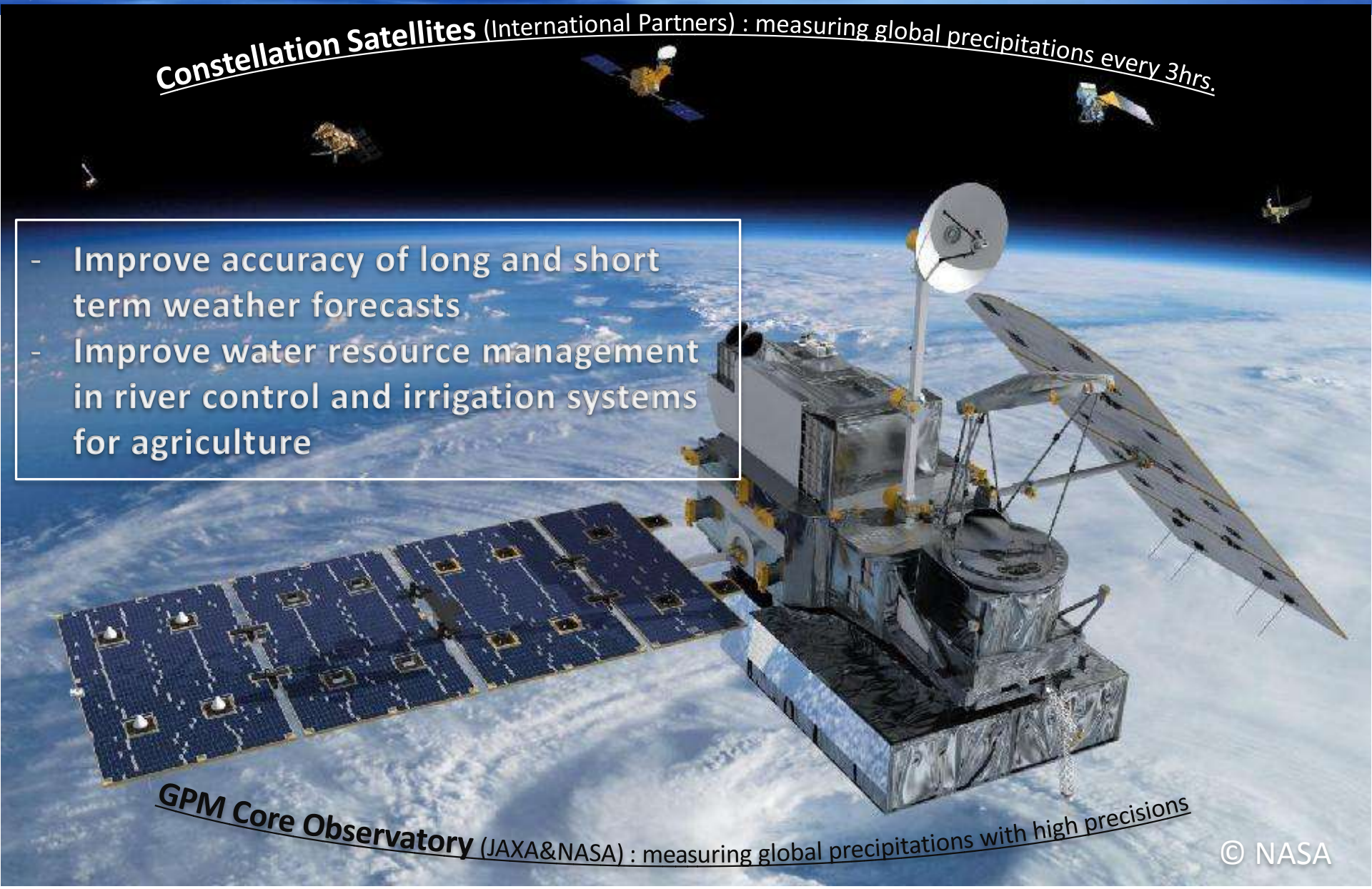
- **Capacity Building and Human Network**

The 9th Sentinel Asia System Operation Training by JAXA, hosted by BPPT in October 2012

The 8th Sentinel Asia System Operation Training by JAXA, hosted by AIT in February 2012


DRM Projects
for Asia Countries

GPM: Global Precipitation Measurement



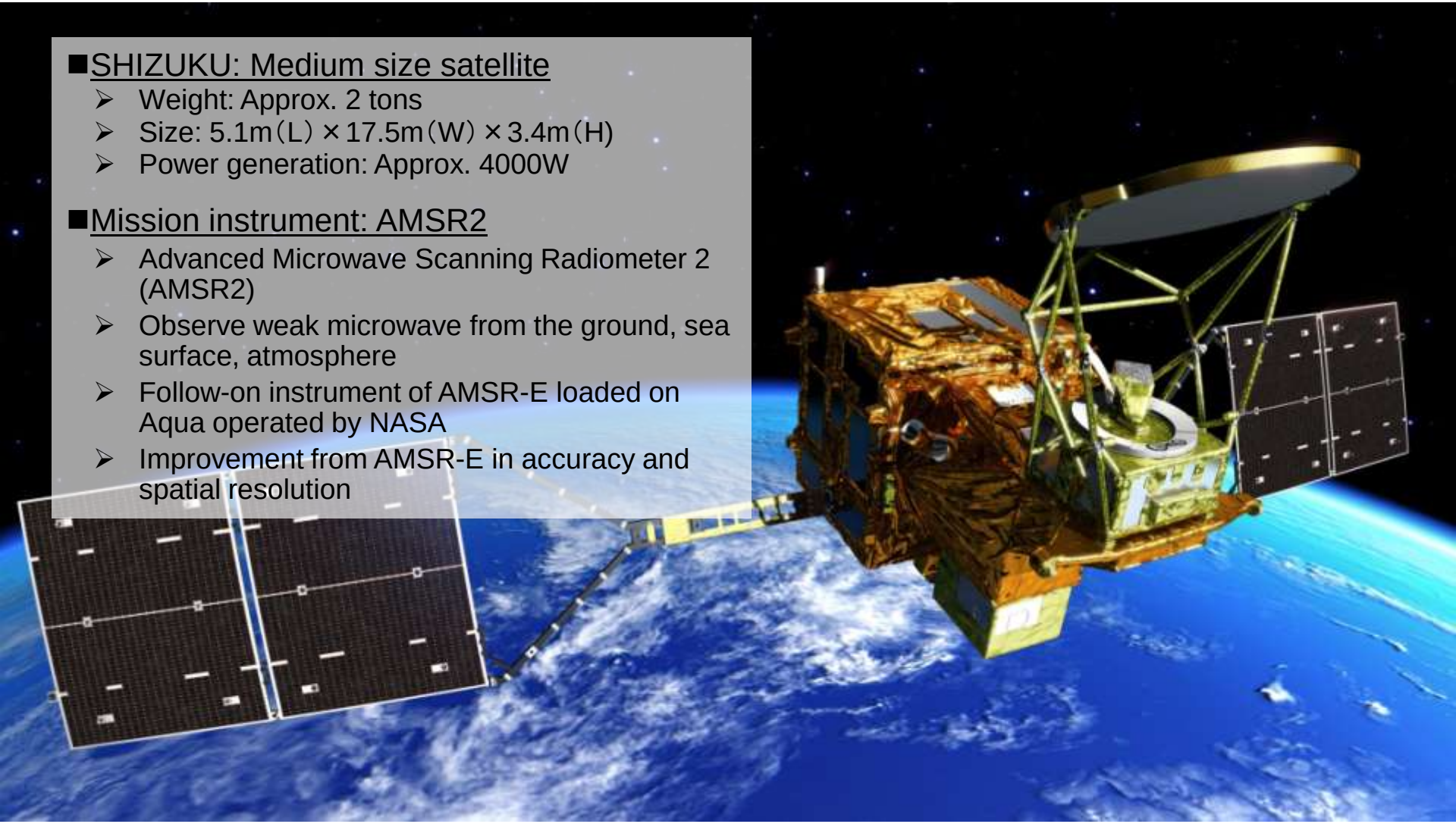
GCOM-W: Global Change Observation Mission - Water

■SHIZUKU: Medium size satellite

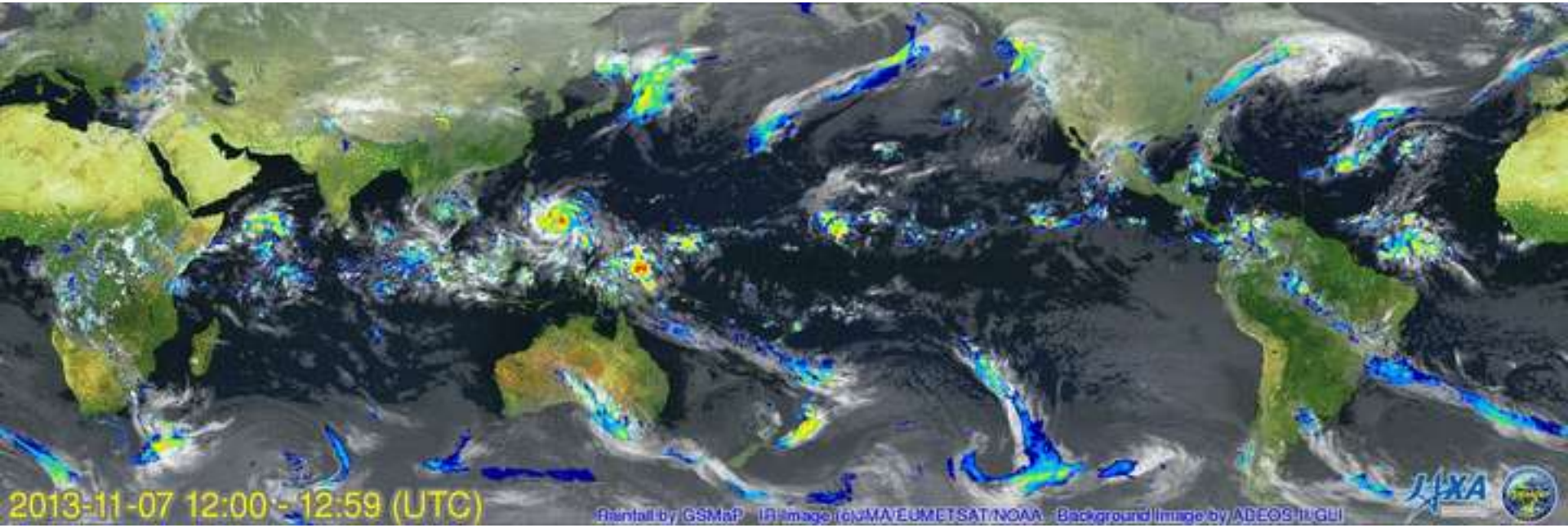
- Weight: Approx. 2 tons
- Size: 5.1m（L）×17.5m（W）×3.4m（H)
- Power generation: Approx. 4000W

■Mission instrument: AMSR2

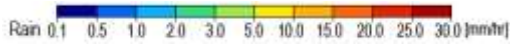
- Advanced Microwave Scanning Radiometer 2 (AMSR2)
- Observe weak microwave from the ground, sea surface, atmosphere
- Follow-on instrument of AMSR-E loaded on Aqua operated by NASA
- Improvement from AMSR-E in accuracy and spatial resolution



GSMaP (Global Satellite Mapping of Precipitation)



Typhoon Haiyan: Nov. 3 – 11, 2013 (Big impact in Philippine)



- Global rainfall map merging GPM, GCOM-W and other satellite information
  - ✓ Available 4-hour after observation, hourly update
  - ✓ 0.1-degree latitude/longitude grid
- GSMaP contribute to flood forecast and early warning in poorly-gauged river basins.

http://sharaku.eorc.jaxa.jp/GSMaP/

Evacuation Drill in Bangladesh in Aug. 2014

Conclusion

- *Space Technology is powerful tool for Disaster Risk Reduction and Management (DRRM),*
- *Sentinel Asia, regional cooperation framework in DRRM using Space Technology, has been fully operated currently and covers preparedness and recovery phases now,*
- *Space Technology in DRRM showed its potential recently,*
- *ALOS-2 was launched successfully, and data distribution of ALOS-2 has just been started from December 2014,*
- *JAXA will continue to make emergency observation by ALOS-2, and to contribute to DRRM around the world.*


JAXA
Explore to Realize